RTR energia

PR15D
Operating Instructions

PRODUCT PROFILE

144 x 144 x 63mm

SPECIFICATIONS

Display	: Liquid crystal display 3 line, 4 digits to show electrical parameters.
Wiring input	: 2 Ø 2 wire, 3 Ø 4 wire, 3 Ø 3 wire, 1 Ø 2 wire.
Rated input voltage	: 11 to 300V AC (L-N) ; 50 to 520V AC (L-L)
Rated input current	: Nominal 5A AC (MIN-11mA, MAX-6A)
Burden	: 20 mOhms
Frequency range	: 45-65 Hz
CT primary	: 1A / 5A to 9999A (programmable for any value)
CT Secondary	: 1A / 5A (programmable for any value)
Display Parameter	: Voltage ,Current ,THDI, THDV, Power Factor, Powers, Temperature.
Display update time	: 1sec for all parameters
Power Consumption	: MAX 15VA
Trip Indication	: LED Blinking
Controlling Range	: Target PF : 0.800 lag to 0.800 lead Switching Program : Automatic
Relay Output	: 12 (Additional 2 for Alarm & Fan)
Alarm	: Over Voltage, Under Voltage, Over Compensate, Under Compensate, THDI Error, No Voltage, THDV Error, Over Temperature,Over Current , CT Error, Connection Error, Current Absent (E01).
Temperature	: -10 to 75°C
Fan Output	: Temperature controlled - Communication in Progress - Fan Mode DI - Digital Input
Environmental Conditions	: Outdoor use Temperature : Operating : 0°C to 60°C Storage : -20°C to 60°C Humidity : 0% to 95% without moisture condensation
Mounting	: Panel Mounting

SERIAL COMMUNICATION

Interface standard and protocol	RS485 AND MODBUS RTU
Communication address	1 to 247
Transmission Mode	Half duplex
Data types	Float and Integer
Transmission distance	500 Meter maximum
Transmission speed	300, 600,1200, 2400, 4800, 9600, 19200 (in bps)
Parity	None, Odd, Even
Stop bits	1 or 2

EMC GUIDELINES

1. Use proper input power cables with shortest connections and twisted type.
2. Layout of connecting cables shall be away from any internal EMI source.

RESOLUTION

1) For Current, Power resolution is automatically adjust as per CT Ratio.
2) For power factor resolution is 0.001 & for temperature ,Voltage resolution is 0.1

ACCURACY

Measurement	Accuracy
Voltage V_{L-N}	±0.5% of Full Scale
Voltage V_{L-L}	±0.5% of Full Scale
Current	±0.5% of Full Scale
Frequency For L-N > 20V, For L-L > 35V	±0.1% of Full Scale

Measurement	Accuracy
Active Power	1%
Apparent power	1%
Reactive Power	1%
Power factor	±0.01
Temperature	±3°C of Full Scale

SAFETY PRECAUTIONS

All safety related codification, symbols and instructions that appear in this operating manual or on the equipment must be strictly followed to ensure the safety of the operating personnel as well as the instrument.

If the equipment is not handled in a manner specified by the manufacturer, it might impair the protection provided by the equipment.

⚠ **CAUTION** : Read Complete instruction prior to installation and operation of the unit.

⚠ **WARNING** : Risk of electric shock.

WIRING GUIDELINES

! WARNING

1. To prevent the risk of electric shock, power supply to the equipment must be kept OFF while doing the wiring arrangement. Do not touch the terminals while power is being supplied.
2. Wiring shall be done strictly according to the terminal layout. Confirm that all connections are correct.
3. Use pin type lugged terminals.
4. To eliminate electromagnetic interference, use wires with adequate ratings and twists of the same in equal size shall be made.
5. Cables used for connection to power source, must have a cross section of

MAINTENANCE

1. The equipment should be cleaned regularly to avoid blockage of ventilating Parts.
2. Clean the eqpment with a clean soft cloth. Do not use Isopropyl alcohol or any other cleaning agent.

INSTALLATION GUIDELINES

⚠ **CAUTION**

1. This equipment, being buit-in type, normally becomes a part of main control panel and in such case the terminals do not remain accessible to the user end after installation and internal wiring.
2. Conductors must not come in contact with the internal circuitry of the equipment or else it may lead to a safety hazard that may in turn endanger life or cause electrical shock to the operator.
3. Before disconnecting the secondary of the external current transformer from the equipment, make sure that the current transformer is short circuited to avoid risk of electrical shock and injury.
4. The equipment shall not be installed in environmental condition other than those mentioned in this manual.
5. Thermal dissipation of equipment is met through ventilation holes provided on chasis of equipment. Such ventilation holes shall not be obstructed else it can lead to a safety hazard.

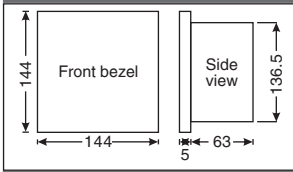
MECHANICAL INSTALLATION / DIMENSIONS

1. Prepare panel cut out with proper dimensions as shown in the figure.
2. Push the meter into the panel cutout. Secure the meter in its place by pushing the clamp on the rear side. The screw of the panel clamp must be in the farthest forward slot.
3. For proper sealing tighten the screw evenly with required torque.

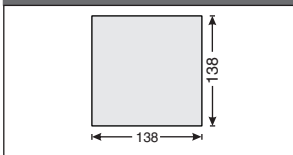
⚠ **CAUTION**

The equipment in its installed state must not come in close proximity to any heating sources, caustic vapors, oils, steam or other unwanted process by product.

OUTLINE DIMENSIONS (in mm)



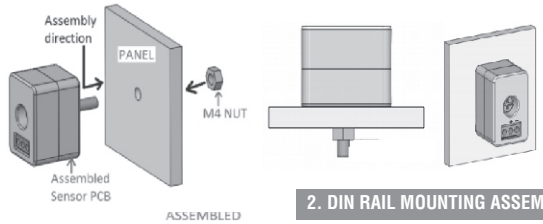
PANEL CUTOUT (in mm)



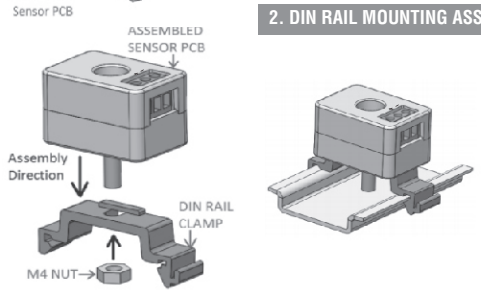
SENSOR CLIP ASSEMBLY

Assemble sensor on the panel /Din rail clamp by using center screw provision and M4 nut. As shown in below diagram.

1. PANEL MOUNTING ASSEMBLY :



2. DIN RAIL MOUNTING ASSEMBLY :



FRONT PANEL DESCRIPTION

KEY DESCRIPTION

Press ↓	To 5 sec. to enter or exit from the configuration menu.
Press ↑	To increment configuration & to move to next page.
Press ↓	To decrement configuration & to move to previous page.
Press ↵	To enter in edit mode and to save settings.
Press AUTO MAN	To toggle from Auto/manual mode.

ONLINE PAGE DESCRIPTION

Use ↑ or ↓ key to scroll through online pages.

KEY	DESCRIPTION For 2P2W
↑	Displays line to line voltage,current,frequency & power factor.
↑	Displays % THD voltage & current. *
↑	Displays active, reactive, apparent power. *
↑	Displays temperature.
KEY	**DESCRIPTION For 1P2W**
↑	Displays line to neutral voltage, current, frequency & power factor for 1st phase.
↑	Displays % THD voltage & current for 1st phase.
↑	Displays active, reactive & apparent power for 1st phase.
↑	Displays temperature.
KEY	**DESCRIPTION For 3P4W**
↑	Displays line to neutral average voltage,current,frequency and average power factor of 3 phase.
↑	Displays power factor of 3 phase & average power factor.
↑	Displays active, reactive & apparent power of 1st phase & average power factor.

*** In 2P2W pages will display when CT ratio is not equals to1.**

KEY	DESCRIPTION For 3P4W
↑	Displays active, reactive & apparent power of 2nd phase & average power factor.
↑	Displays active, reactive & apparent power of 3rd phase & average power factor.
↑	Displays total active, reactive & apparent power of 3 phases.
↑	Displays temperature.
↑	Displays line to neutral voltage of 3 phases & average voltage.
↑	Displays line to line voltage of 3 phases & average voltage.
↑	Displays % THD of line to neutral voltage & average %THD voltage of 3 phases .
↑	Displays % THD of line to line voltage & average %THD of voltage of 3 phases.
↑	Displays current of 3 phases & average current.
↑	Displays % THD of current of 3 phases & average %THD of current.
↑	Displays line to neutral voltage, current, frequency & power factor of 1st phase.
↑	Displays line to neutral voltage, current, frequency & power factor of 2nd phase.
↑	Displays line to neutral voltage, current, frequency & power factor of 3rd phase.
KEY	**DESCRIPTION For 3P3W**
↑	Displays line to line average voltage, current, frequency & average power factor.
↑	Displays power factor of 3 phase & average power factor.
↑	Displays active, reactive & apparent power of 1st phase & average power factor.
↑	Displays active, reactive & apparent power of 2nd phase & average power factor.
↑	Displays active, reactive & apparent power of 3rd phase & average power factor.
↑	Displays total active, reactive & apparent power of 3 phase.
↑	Displays temperature.
↑	Displays line to line voltage of 3 phases & average voltage.
↑	Displays % THD of line to line voltage & average % THD of voltage of 3 phases .
↑	Displays current of 3 phases & average current.
↑	Displays % THD of current & average %THD of current of 3 phases.
↑	Displays line to line voltage(1-2), current, frequency & average power factor.
↑	Displays line to line voltage(2-3), current, frequency & average power factor.
↑	Displays line to line voltage(3-1), current, frequency & average power factor.

CT ERROR

If current connection is reversed,APFC will show in which phase connection is reversed. If more than one phase reverse, it will display combination of both.
1 - 1st phase, 2 - 2nd phase, 3 - 3rd phase.

SERIAL NUMBER DESCRIPTION

Press ↵ key for 3 sec to display 8 digit serial number at last row of display.

LED INDICATIONS

LED	DESCRIPTION
ALM	No fault condition present.
ALM [Blinking]	Fault condition occurred. [Press ↵ key to display trip parameter.]
ALM	This will take place when user will press ↵ key in fault condition. Trip parameters will be displayed for 3sec each.

NOTE :
On occurrence of any new fault condition ALM LED starts blinking again & on pressing ↵ key all trip parameters will be displayed for 3sec each.

AUTO / MANUAL MODE DESCRIPTION

Press AUTO MAN key for 5 sec to change control mode(Auto/Manual).

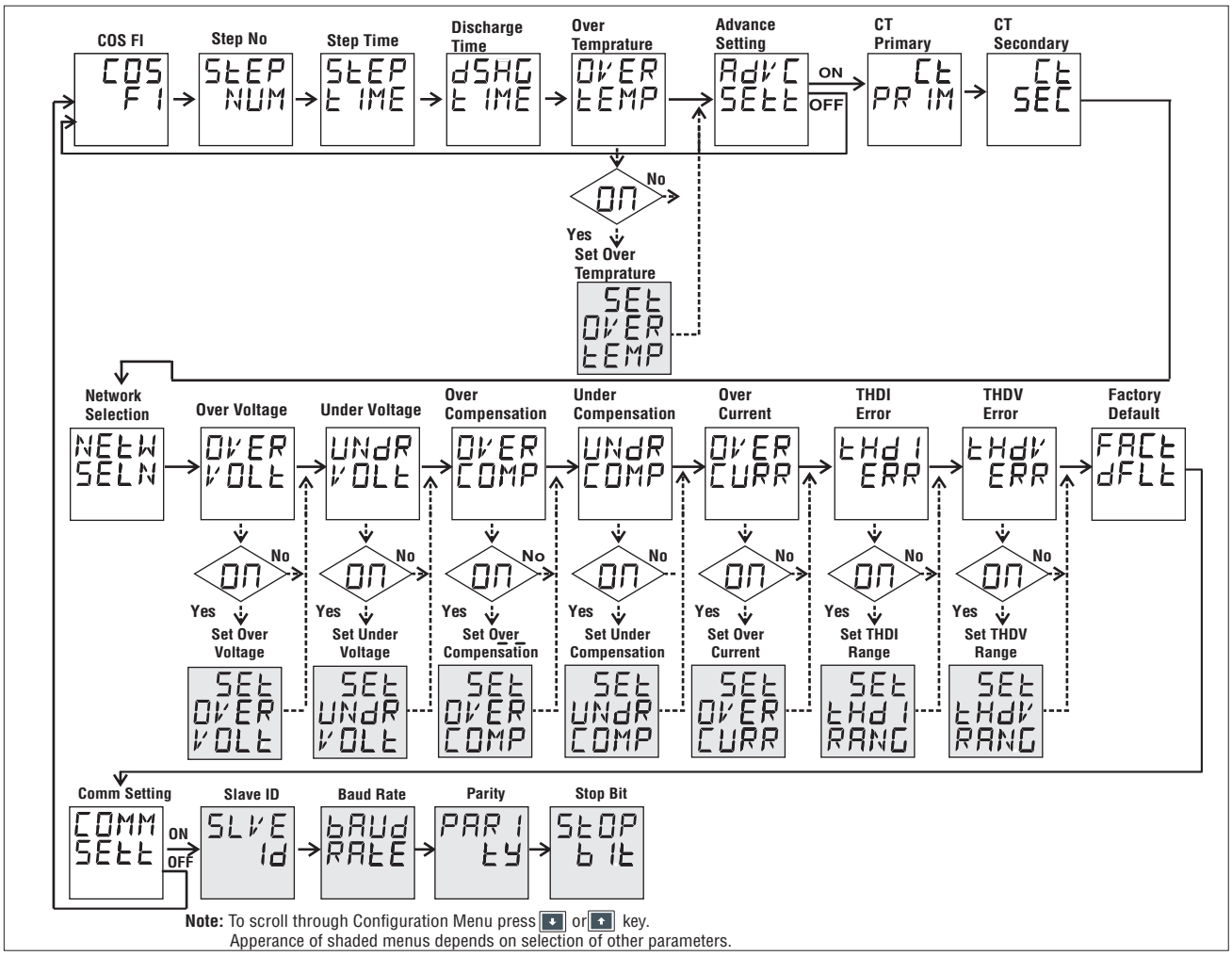
Press ↑ key to turn ON relay and ↓ key to turn OFF relay one by one in manual mode.

CONFIGURATION MENU

Press Decrement ( ) key for 5 sec to enter or exit from configuration menu.

There are 3 dedicated keys , , , to enter into configuration menu / change setting.

NOTE : The setting should be done by a professional after going through this operating manual.



Note: To scroll through Configuration Menu press or key.
Apperance of shaded menus depends on selection of other parameters.

CONFIGURATION TABLE

Parameter	Display	Range	Default Value	Condition
Cos FI	COS FI	0.800 to -0.800	1.000	-
Step No	STEP NUM	1 to 14	12	-
Step Time	STEP TIME	1 to 999S	15S	-
Discharge Time (Reconnection Time)	DSHG TIME	5 to 999S	10S	-
Over temperature	OVER TEMP	ON/OFF	OFF	-
Set Over temperature	SET OVER TEMP	-10˚C to 75˚C	55˚C	*Promted only if Over Temperature set to ON
Advanced Setting*	ADVC SETT	ON/OFF	OFF	-
CT Primary	CT PRIM	1A/5A-9999A	5A	1-9999 (CT SEC= 1) 5-9999 (CT SEC= 5)
CT Secondary	CT SEC	1A/5A	5A	-
Network Selection	NETW SELN	3P4W/3P3W 2P2W/1P2W	2P2W	-
Over Voltage	OVER VOLT	ON/OFF	OFF	-
Set Over Voltage	SET OVER VOLT	5% to 50%	10%	*Prompted only if Over Volt set to ON
Under Voltage	UNDR VOLT	ON/OFF	OFF	-
Set Under Voltage	SET UNDR VOLT	5% to 50%	10%	*Prompted only if Under Voltage set to ON
Over Compensation	OVER COMP	ON/OFF	OFF	-
Set Over Compensation	SET OVER COMP	0.800 to -0.800	-0.999	*Prompted only if Over Comp set to ON
Under Compensation	UNDR COMP	ON/OFF	OFF	-
Set Under Compensation	SET UNDR COMP	0.800 to -0.800	0.940	*Prompted only If Under Comp set to ON
Over Current	OVER CURR	ON/OFF	OFF	-

*Menu after Advance Setting will appear if advance setting set to ON

Parameter	Display	Range	Default Value	Condition
Set Over Current	SET OVER CURR	5% to 20%	10%	*Prompted If Over Current set to ON
THD Current Error	THDI ERR	ON/OFF	OFF	-
THD Current Range	SET THDI RANG	10% to 100%	30%	*Prompted only If THD Current Error set to ON
THD Voltage Error	THDV ERR	ON/OFF	OFF	-
THD Voltage Range	SET THDV RANG	1% to 100%	3%	*Prompted only If THD Volt Error set to ON
Factory Default	FACT DFLT	YES/NO	NO	-
Communication Setting	COMM SETT	ON/OFF	OFF	-
Slave ID	SLVE ID	1 to 247	1	*Prompted only if Communication Setting set to ON
Baud Rate	BAUD RATE	300/600/1200/2400/ 4800/9600/19k2	9600	
Parity	PARITY	None/Even/Odd	None	
Stop Bit	STOP BIT	1 or 2	1	

USER GUIDE

a) Manual switching (Manual Mode) :

1) When this switching program is selected,the capacitor steps are controlled manually by the user.

2) DI : When user selects manual switching through Auto / Manual switch on the panel, then all the relays that are 'ON' through APFC are turned 'OFF' and Then user can manually turn every capacitor bank through push button available on panel for respective banks. In this case APFC has no more control and it switches off all bank that it was earlier controlling.

b) Automatic switching : This automatic switching program uses intelligent switching sequence. The step switching sequence is not fixed and The program automatically selects the most appropriate steps to switch in or **o**ut in order to achieve shortest reaction time with minimum number of steps.

MODBUS REGISTER ADDRESSES LIST

Readable parameter:[Length (Register) : 2;Data structure :Float, For Error:length (Register) : 1; Data structure: Integer]

Address	Hex Address	Parameter
30000	0x00	Voltage VTN
30002	0x02	Voltage V2N
30004	0x04	Voltage V3N
30006	0x06	Average Voltage LN
30008	0x08	Voltage V12
30010	0x0A	Voltage V23
30012	0x0C	Voltage V31
30014	0x0E	Average Voltage LL
30016	0x10	Current I1
30018	0x12	Current I2
30020	0x14	Current I3
30022	0x16	Average current
30024	0x18	kW1
30026	0x1A	kW2
30028	0x1C	kW3
30030	0x1E	kVA1
30032	0x20	kVA2
30034	0x22	kVA3
30036	0x24	kVAr1
30038	0x26	kVAr2
30040	0x28	kVAr3
30042	0x2A	Total kW
30044	0x2C	Total kVA
30046	0x2E	Total kVAr
30048	0x30	PF1
30050	0x32	PF2
30052	0x34	PF3

Address	Hex Address	Parameter
30054	0x36	Average PF
30056	0x38	Frequency
30082	0x52	Temperature
30084	0x54	DI Status
30085	0x55	Over Voltage Error
30086	0x56	Under Voltage Error
30087	0x57	Over Compensation error
30088	0x58	Under Compensation error
30089	0x59	CT Error
30090	0x5A	NO Voltage
30091	0x5B	Over Current Error
30092	0x5C	THDI Error
30093	0x5D	THDV Error
30094	0x5E	Over Temperature Error
30684	0x2AC	Serial number of unit
30700-30726	0x2BC - 0x2D6	Bank1 - Bank 12/14* Value

Note: For Error 0:No Error; 1: Error Present

Total Harmonic Distortion(THD)		
30124	0x7C	THD of Voltage V1N
30126	0x7E	THD of Voltage V2N
30128	0x80	THD of Voltage V3N
30130	0x82	THD of Voltage V12
30132	0x84	THD of Voltage V13
30134	0x86	THD of Voltage V31
30136	0x88	THD of Current I1
30138	0x8A	THD of Current I2
30140	0x8C	THD of Current I3

Note: For Status 0:OFF;1:ON

{142 + [(Harmonic no-2) x 2] + 60 x Constant Parameter }
For Example,
To find the 14th Harmonic address of Voltage V31 following formula can be used:
Formula with the parameter :
{142 + [(Harmonic no-2) x 2] + 60 x C P}
Eg. {142 + [(14-2) x 2] + 60 x 5} = 466
So, Check the 14th Harmonic of Voltage V31 at 466 address.

Formula to find address of individual Harmonic	
Constant Parameter	Meaning
0	Voltage V1N
1	Voltage V2N
2	Voltage V3N
3	Voltage V12
4	Voltage V23
5	Voltage V31
6	Current I1
7	Current I2
8	Current I3

Readable / writable parameters :

Address	Hex Address	Parameter	Range	Length (Register)	Data Structure
40029	0x1D	Control Mode	1: Manual; 0:Auto	1	Integer
40030	0x1E	Relay 1	1:ON ; 0: OFF	1	Integer
40031	0x1F	Relay 2	1:ON ; 0: OFF	1	Integer
40032	0x20	Relay 3	1:ON ; 0: OFF	1	Integer
40033	0x21	Relay 4	1:ON ; 0: OFF	1	Integer
40034	0x22	Relay 5	1:ON ; 0: OFF	1	Integer
40035	0x23	Relay 6	1:ON ; 0: OFF	1	Integer
40036	0x24	Relay 7	1:ON ; 0: OFF	1	Integer
40037	0x25	Relay 8	1:ON ; 0: OFF	1	Integer
40038	0x26	Relay 9	1:ON ; 0: OFF	1	Integer
40039	0x27	Relay 10	1:ON ; 0: OFF	1	Integer
40040	0x28	Relay 11	1:ON ; 0: OFF	1	Integer
40041	0x29	Relay 12	1:ON ; 0: OFF	1	Integer
40042	0x2A	Relay 13	1:ON ; 0: OFF	1	Integer
40043	0x2B	Relay 14	1:ON ; 0: OFF	1	Integer

NOTE: If Control mode is switched to Manual mode then only relay status can change possible.
*13 & 14 relay will be used for control switching only when customer selects 14 relay in config. else ALARM & FAN respectively.

Readable / writable parameters :

Address	Hex Address	Parameter	Range		Length (Register)	Data Structure
40000	0x00	Cos FI	800	-800	1	Signed Integer
40001	0x01	Step no.	1	14	1	Integer
40002	0x02	Step Time	1	999	1	Integer
40003	0x03	Discharge Time	5	999	1	Integer
40004	0x04	Over Temperature	0: OFF: 1:ON		1	Integer
40005	0x05	Set Over Temperature	-10	75	1	Signed Integer
40006	0x06	CT Primary	1/5	9999	1	Integer
40007	0x07	CT Secondary	1/5		1	Integer
			Value	Meaning		
40008	0x08	Network Selection	0	3P4W	1	Integer
			1	3P3W		
			2	2P2W		
			3	1P2W		
40009	0x09	Over Voltage	0: OFF: 1:ON		1	Integer
40010	0x0A	Set Over Voltage	5%	50%	1	Integer
40011	0x0B	Under Voltage	0: OFF: 1:ON		1	Integer
40012	0x0C	Set Under Voltage	5%	50%	1	Integer
40013	0x0D	Over Compensation	0: OFF: 1:ON		1	Integer
40014	0x0E	Set Over Compensation	0.800	-0.800	1	Signed Integer
40015	0x0F	Under Compensation	0: OFF: 1:ON		1	Integer
40016	0x10	Set Under Compensation	0.800	-0.800	1	Signed Integer
40017	0x11	Over Current	0: OFF: 1:ON		1	Integer
40018	0x12	Set Over Current	5%	20%	1	Integer
40019	0x13	THDI Error	0: OFF: 1:ON		1	Integer
40020	0x14	THDI Range	10%	100%	1	Integer
40021	0x15	THDV Error	0: OFF: 1:ON		1	Integer
40022	0x16	THDV Range	1%	100%	1	Integer
40023	0x17	Factory Default	1	Set to factory setting range	1	Integer
40024	0x18	Comm setting	0: OFF: 1:ON		1	Integer
40025	0x19	Slave ID	1	247	1	Integer
			Value	Meaning		
40026	0x1A	Baud Rate	0x0000	300	1	Integer
			0x0001	600		
			0x0002	1200		
			0x0003	2400		
			0x0003	4800		
			0x0005	9600		
			0x0006	19200		
			Value	Meaning		
40027	0x1B	Parity	0x0000	None	1	Integer
			0x0001	Odd		
			0x0002	Even		
40028	0x1C	Stop bit	0x0000	1	1	Integer
			0x0001	2		

NOTE :

1) Reauto - Initialization will be done at every power on if voltage is present and if CT ratio changed.
2) If DI is high controller work in manual mode & if Low return to 'Auto' mode.
3) If DI is high Auto Initialization will not take place.
4) Recommended that number of relays not to be changed during normal operation If done so, restart the controller.

FAN SETTINGS

SETTING	DESCRIPTION
Temprature ON/OFF (Setting range = -10°C to 75°C)	Fan output will turn on when the temperature exceed user set value.

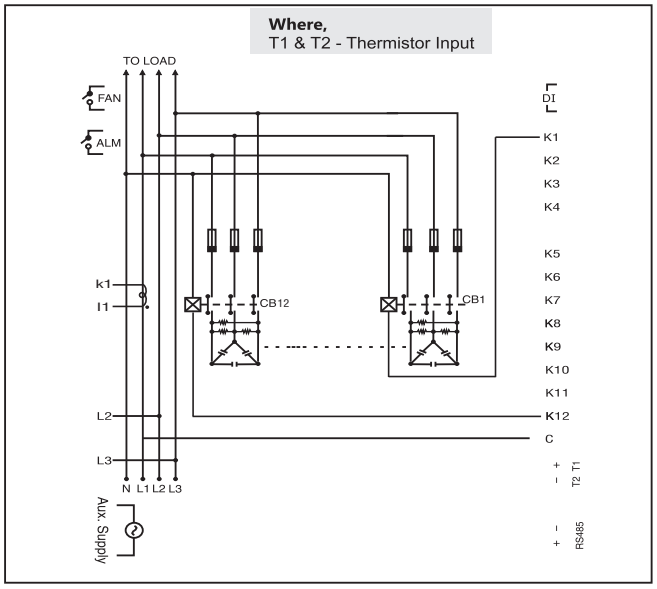
TRIP TIMING

Parameter	Display	Active	Deactive	Action to be taken by APFC
No Voltage	NO VOLT	Instantaneous	Instantaneous	Disconnect All Steps
Over Voltage	OVER VOLT	Instantaneous	15s	Disconnect All Steps
Under Voltage	UNDR VOLT	15s	15s	Disconnect All Steps
Over Compensate	OVER COMP	15s	Instantaneous	-
Under Compensate	UNDER COMP	Instantaneous	Instantaneous	-

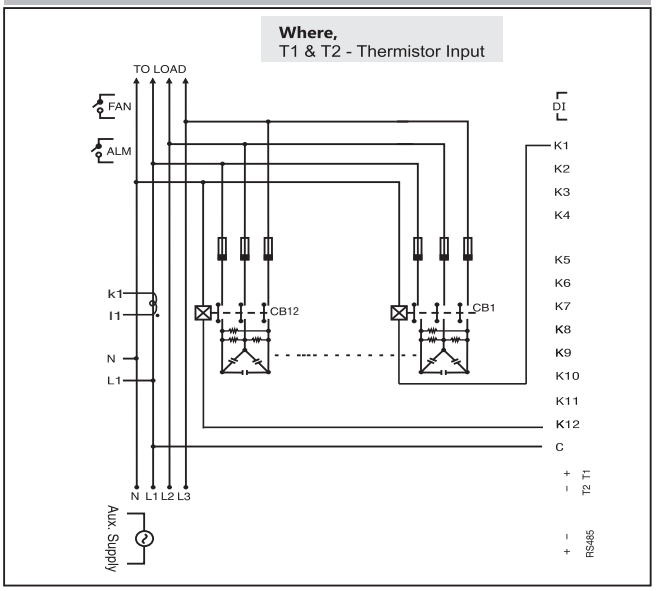
Parameter	Display	Active	Deactive	Action to be taken by APFC
Over temperture	OVER TEMP	15s	15s	Disconnect All Steps
THDI	THDI ERR	1 Min	1 Min	Disconnect All Steps (After 5min)
THDV	THDV ERR	1 Min	1 Min	Disconnect All Steps (After 5min)
Over Current	OVER CURR	15s	15s	Disconnect All Steps
CT Polarity Error	CT ERR	Instantaneous	Instantaneous	-

WIRING DIAGRAM

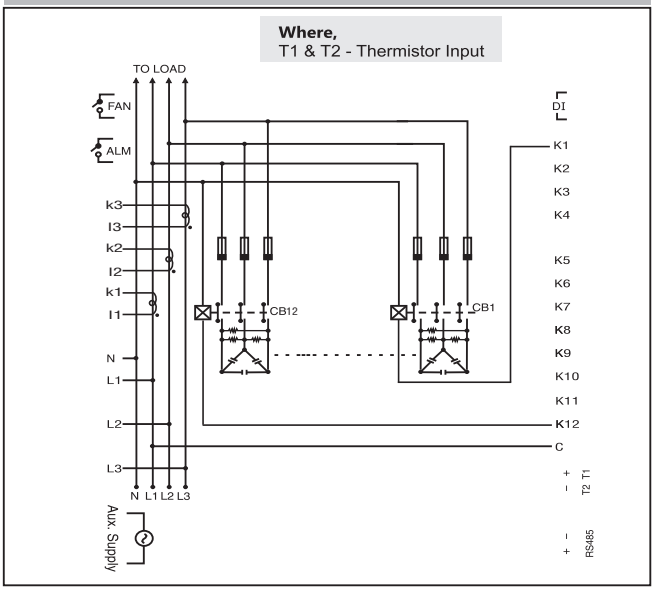
2 PHASE - 2 WIRE



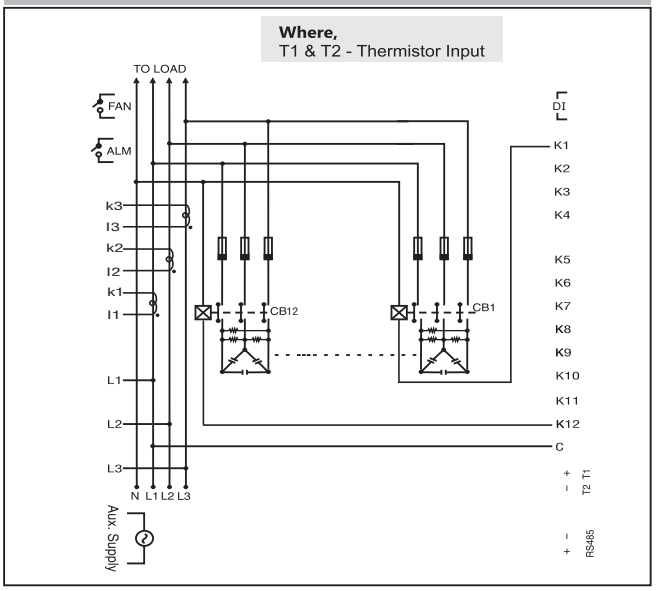
1 PHASE - 2 WIRE



3 PHASE - 4 WIRE



3 PHASE - 3 WIRE



NOTE :
- For N/W selection 2P2W voltage (VLL) applied between L2 & L3 and connect CT between k1 & I1[Do not use L1,N, k2 & I2,k3 & I3]
- For N/W selection 1P2W voltage (VLN) applied between L1 & N and connect CT between k1 & I1[Do not use L2,L3, k2 & I2,k3 & I3]